

REMARKS

Claims 1 and 6 have been amended.

The Examiner has rejected applicant's claims 1-10 under 35 USC 103(a) as being unpatentable over the Lin, et al. (U.S. Patent No. 6,069,973) in view of the TeWinkle (U.S. Patent No. 7,164,506) patent and Okisu, et al. (U.S. Patent No. 6,571,022) patents.

Applicant has amended applicant's independent claims 1 and 6, and with respect to these claims, as amended, and their respective dependent claims, the Examiner's rejection is respectfully traversed.

Applicant's independent claim 1 has been amended to recite an image sensing apparatus comprising: an image sensing element includes a first light receiving area and a second light receiving area which are formed on an image pickup surface of a semiconductor substrate by a plurality of divisional joint exposure operations, wherein pixel signals obtained by the first light receiving area and the second light receiving area are read out from the image sensing element via a same channel; a correction device which corrects difference between output levels of pixel signals output from the first light receiving area and the second light receiving area via the same channel, wherein said correction device simultaneously corrects, by a gain correction, a difference between levels of output signals from the first light receiving area and the second light receiving area, and a difference between levels of output signals of output channels included in the same channel; and a control device which controls to write a signal corrected by said correction device to a frame memory. Independent claim 6 has been similarly amended.

In accordance with applicant's claimed invention of independent claims 1 and 6, an image sensor is manufactured by connecting multiple receiving areas to create a single

image sensing surface of the image sensor, wherein the light receiving areas are formed as integral parts of the image sensing surface by a plurality divisional joint exposure operations. Applicant's claimed invention is directed to correcting differences between output signals caused by the plurality of divisional joint exposure operations by correcting simultaneously, by a gain correction, a difference between levels of output signals from a first and second receiving areas and a difference between levels of output signals of output channels included in the same channel.

The cited art of record does not teach or suggest such features. In particular, the cited Lin, et al., TeWinkle, and Okisu, et al. patents, alone or in combination with one another, do not teach or suggest a correction device that simultaneously corrects, by a gain correction, a difference between levels of output signals from the first light receiving area and the second light receiving area, and a difference between levels of output signals of output channels included in the same channel, wherein the first and second light receiving areas have been formed by the divisional joint exposure operations during manufacturing of the image sensing element to form a single image sensing surface of the image sensing element, as recited in applicant's independent claims 1 and 6 in one form or another.

The Examiner has argued that the combination of Lin, et al. and TeWinkle teaches all features of applicant's claim 1 with the exception of the control device. (See Office Action, page 5). In particular, the Examiner has argued that Lin, et al. teaches an image sensing apparatus (FIG. 1: color copier 100), which comprises an image sensing element (FIG. 2: image sensor array 1) that includes a first light receiving area (chip 3A) and a second light receiving area (chip 3B), which are formed by a plurality of divisional exposure operations. The Examiner has reasoned that since in Lin, et al., the first and

second light receiving areas (chips 3A and 3B) are different chips bonded to form an array, these areas are formed by a plurality of divisional joint exposure operations. The Examiner has further argued that Lin, et al. discloses a correction device for correcting for the difference between output levels of pixel signal outputs from the first and second light receiving areas because Lin, et al. discloses a data processor that provides a chip-to-chip image signal correction, wherein the chips are corrected to output uniform image signals. (See Office Action , page 3). Applicant respectfully disagrees with the Examiner's arguments.

Lin, et al. discloses a method for calibrating a multi-chip color image sensor (1) by successively controlling the image sensor to image three different test targets and for generating respective sets of correction factors, wherein the first set corrects for pixel-to-pixel variations between imaging elements of the image sensor, the second set corrects for chip-to-chip variations between chips of the image sensor, and the third set corrects for array-wide variations of the image sensor. (See Abstract, FIG. 4, col. 1, line 58 – col. 2, line 26). In Lin, et al., the multi-chip image sensor is an FWA-sensor in which an effective area has been enlarged by joining (bonding) a plurality of sensor chips (3) together to form the single multi-chip image sensor. That is, in Lin, et al., each sensor chip of the multi-chip image sensor is a discrete chip with its own variations caused by non-uniformity in the color filter coating thickness on each chip. (See col. 1, lines 11-57; col. 5, lines 9-11). However, nowhere does Lin, et al. describe the chips of the multi-chip sensor being formed on a surface of the multi-chip image sensor by a plurality of divisional joint exposure operations, and thus, Lin, et al. cannot and does not teach or suggest the image sensing element recited in applicant's claims.

Furthermore, Lin, et al. teaches generating different correction factors in a different manner for correcting respectively for pixel-to-pixel, chip-to-chip, and wide array variations. Lin, et al., however, is completely silent as to any variations caused by the divisional joint exposure operations that form the first and second light receiving areas integrally connected to form a single image sensing surface of the image sensing element. Therefore, Lin, et al. simply cannot teach or suggest correcting the differences between output levels of pixel signals output from the light receiving areas formed by divisional joint exposure operations, let alone correcting simultaneously, by a gain correction, a difference between levels of output signals from the first light receiving area and the second light receiving area and a difference between levels of output signals of output channels included in the same channel.

In the Office Action, the Examiner has acknowledged that Lin, et al. does not explicitly teach that the first and second light receiving areas are formed on an image pickup surface of a semiconductor substrate or that pixel signals obtained by the first and second receiving areas are read out via the same channel. However, the Examiner has argued that TeWinkle teaches an image sensing apparatus (FIG. 7), which comprises an image sensing element (image sensor array chips 12) including a first light receiving area (chip "I") and a second light receiving area (chip "II") formed on an image pickup surface of a semiconductor substrate (substrate 14 of FIG. 1) by a plurality of divisional exposure operations, wherein the chips are butted end to end to form a single array of photosensors on the substrate (14). The Examiner has further argued that TeWinkle teaches reading out pixel signals obtained by the first and second receiving areas (chips "I" and "II") from the

image sensing element via the same channel because the chips are connected in serial such that they are all output onto a common output line to act as one large chip with a single shift register. The Examiner has reasoned that it would have been obvious to one skilled in the art to have the first and second light receiving areas of Lin, et al. connected on a semiconductor substrate such that they read out from the image sensing element via the same channel as taught by TeWinkle to yield the predictable result of outputting image data in a single stream. (See Office Action, pages 3-5). Applicant respectfully disagrees with the Examiner's arguments.

More specifically, as discussed in applicant's previous response, TeWinkle discloses an optical sensor in which an effective area is enlarged by joining a plurality of discrete sensor chips. In particular, TeWinkle discloses that the optical sensor has a plurality of image sensor array chips (12) mounted on a substrate and butted end-to-end. (See col. 2, lines 65-66). TeWinkle further discloses that data can be output from the chips serially into a common output line or, in an alternative arrangement of the optical sensor, into separate parallel channels. However, this structure of the optical sensor, as described in TeWinkel, is different from that of applicant's claimed image sensing element.

In particular, in applicant's claimed invention, the image sensing element is manufactured with a single image sensing surface, which is formed by connecting at least first and second areas formed by a plurality of divisional joint exposure operations. That is, the image sensing element recited in applicant's claims has a single image sensing surface that includes two light receiving areas which are integral parts of the single image sensing surface of a single image sensing element. In contrast, though TeWinkle describes that the image sensor array acts in effect as one large chip, the image sensor array of TeWinkle

includes multiple discrete chips arranged next to one another, with each chip having its own image sensing surface, and thus, the image sensor of TeWinkle has multiple image sensing surfaces.

Furthermore, TeWinkle makes no mention of the image sensor array having chips that have been formed on a surface of the image sensor array by a plurality of divisional joint exposure operations. The Examiner appears to argue that such a feature is disclosed in col. 2, line 62 – col. 3, line 4 of TeWinkle, wherein chips are manufactured, inherently, by using a plurality of joint exposure operations. (See Office Action, page 4). However, the cited portion of TeWinkle merely describes how the chips are arranged in the array, but is completely silent as to how the chips are manufactured or that manufacturing of the image sensor array would include a plurality of divisional joint exposure operations on the array surface to form the chips. Rather, throughout the disclosure, TeWinkle describes chips as individual discrete components (separate integrated circuits) that have been butted together to form an image sensor array. (See e.g., col. 1, lines 31-43). Since the chips of TeWinkle are individual components that are merely butted together, TeWinkle does not teach or suggest that the image sensor array has been manufactured using a plurality of divisional joint exposure operations to form the chips on the surface of the image sensor array, as required by applicant's independent claims.

Moreover, TeWinkle makes no mention of a correction device that simultaneously corrects, by a gain correction, a difference between levels of output signals from the first light receiving area and the second light receiving area, and a difference between levels of output signals of output channels included in the same channel, as recited in applicant's independent claims. Rather, TeWinkle merely discloses the chips in the image sensor array

could be arranged to be operated in series to output data into a common channel or could be arranged to be operated in parallel to output data into separate parallel channels. However, TeWinkle is completely silent as to correcting outputted data, and thus cannot and does not teach the correction device of applicant's independent claims. Accordingly, TeWinkle does not teach or suggest a correction device that simultaneously corrects, by a gain correction, a difference between levels of output signals from the first light receiving area and the second light receiving area, and a difference between levels of output signals of output channels included in the same channel wherein the first and second light receiving areas having been formed by the divisional joint exposure operations during manufacturing of the image sensing element and have been connected to form a single image sensing surface of the image sensing element, as recited in applicant's independent claims.

The cited Okisu, et al. also fails to disclose applicant's correction device and image sensing element. Rather, Okisu, et al. is directed to an image processing apparatus that synthesizes a plurality of overlapping partial images into a single image to form an entire image of an object. (See Abstract; col. 1, lines 10-13; col. 2, lines 48-60). In particular, Okitsu, et al. discloses obtaining partial images using two different and distant image sensors (12, 13), wherein the light enters the sensors via an optic path separator (11) such that an overlap (W) is created between the partial images obtained by the sensors (12, 13). (See FIGS. 2, 3, 8, 9 and col.6, lines 15-35).

However, Okisu, et al. makes no mention of manufacturing an image sensing element including multiple receiving areas formed by a plurality of divisional joint exposure operations, let alone correcting, simultaneously, differences between levels of output signals from a first light receiving area the image sensing element and a second light

receiving area of the image sensing element, and a difference between levels of output signals of output channels included in the same channel wherein the first and second light receiving areas have been formed by the plurality of divisional joint exposure operations during manufacturing of the image sensing element. Rather, Okitsu, et al. merely discloses using distinct and remote sensors to obtain overlapping pictures, which are synthesized to create a single picture. Thus, Okitsu, et al. also fails to teach or suggest applicant's claimed image sensing element and correction device.

In sum, the cited Lin, et al., TeWinkle, and Okisu references at most disclose that an optical sensor may be manufactured by joining a plurality of discrete chips. However, the cited references are silent as to the manufacturing process including a plurality of divisional joint exposure operations for forming the sensor chips on the surface of the optical sensor or the light receiving areas on the surface of each of the chips of the optical sensor. Furthermore, the cited references make no mention of differences in output signals from the light receiving areas caused by the plurality of divisional joint exposure operations in the manufacturing process, in particular, in the manufacturing process of a single chip. Consequently, the cited references cannot, and do not teach, correcting a difference in the signals caused by the plurality of divisional exposure operations in the manufacturing process of the single chip such that a difference between levels of output signals from a first light receiving area and a second light receiving area of the chip and a difference between levels of output signals of output channels included in a same channel are simultaneously corrected, as required by applicant's independent claims 1 and 6.

Accordingly, applicant's amended independent claims 1 and 6, which recite, in one form or another, an image sensing element including a first light receiving area and a

second light receiving area, which are formed on an image pickup surface of a semiconductor substrate by a plurality of divisional joint exposure operations, wherein a plurality of color filters of a Bayer arrangement are arrayed on the first and second light receiving areas and pixel signals obtained by the first light receiving area and the second light receiving area are read out from the image sensing apparatus via a same channel, and a correction device which corrects the difference between output levels of pixel signals output from the first light receiving area and the second light receiving area via the same channel, and their respective dependent claims, patentably distinguish over the Lin, et al., TeWinkle, and Okisu, et al. references.

In view of the above, it is submitted that applicant's claims patentably distinguish over the cited references. Accordingly, reconsideration of the claims is respectfully requested.

If the Examiner believes that an interview would expedite consideration of this Amendment or of the application to issue, a request is made that the Examiner telephone applicant's undersigned attorney at (212) 790-9225.

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Respectfully submitted



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